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No. 179

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THE WESTLAND "WALLACE" GENERAL-PURPOSE AIRPLANE (BRITISH)  
An All-Metal Biplane

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Washington, D. C.

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# NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

## AIRCRAFT CIRCULAR NO. 179

### THE WESTLAND "WALLACE" GENERAL-PURPOSE AIRPLANE (BRITISH)\*

#### An All-Metal Biplane

Originally designed as a private venture, known as the "P.V.6," the version used in the British Royal Air Force has been given the name "Wallace," and is of the class known as "general purpose." As the class title indicates, airplanes must be adaptable to a great variety of purposes, and the demands made are by no means easy to meet, as will be realized when we point out that general-purpose airplanes must have a flight range of at least five hours, must be capable of carrying a fairly heavy bomb load, must be equipped for taking photographs and for radio communication with ground troops and guns, must carry oxygen apparatus for high flying, must carry fixed and movable machine guns, and must be fitted with dual flying controls. Yet in spite of all these demands the general-purpose airplanes must have a good performance. Thus, somewhat paradoxically, the design of a general-purpose airplane has become very much a specialized task.

Due to the extra power of the Bristol "Pegasus" M.3 engine (555 b.hp as compared with the 460 b.hp of the "Jupiter") and the improved aerodynamic design of the "Wallace," the latest airplane has a very much better performance. For example, the maximum speed of the "Wallace" at 5,000 feet is 161 miles per hour, and the climbing time to 10,000 feet is 8.8 minutes. The service ceiling of the "Wallace" is 22,800 feet.

Figures 1, 2, and 3 show the general lines of the "Wallace." Structurally the "Wallace" follows the principle and methods which have been found so successful in a former type. The airplane is an all-metal biplane, and can be supplied equipped with a number of alternative power plants, such as the Bristol "Pegasus," the Armstrong-Siddeley "Jaguar" or "Panther," or the Gnome-Rhone "Mistral." The Royal Air Force version is, as already stated, fitted with the Bristol "Pegasus" M.3.

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\*From Flight, May 4, 1933.

The fuselage (figs. 4 and 5) is constructed in the familiar Westland manner, of tubes of approximately square section. Joints are made by flat flitch plates and tubular steel rivets. In the forward portion of the fuselage the structure is of the rigid type, with bracing formed by diagonal tubes, while the rear fuselage portion is braced by swaged rods. This type of construction is extremely simple, and has been found very easy to maintain and repair.

The biplane wings are of the staggered, two-bay arrangement, and are of equal span and chord. They have corrugated steel strip spars of box section (fig. 6), and are detachable at top center section and fuselage. Ailerons of the Frise type are fitted to upper and lower wings, and Handley Page automatic wing-tip slots are fitted to the upper wing. The interplane struts are of streamline section, and built-up steel construction. External bracing is by RAF wire. The tail organs are of duralumin construction.

The covering of the front portion of the fuselage is of aluminum, arranged in the form of easily detachable panels. The rear portion of the fuselage (fig. 7) is covered with doped fabric, as is also the wing covering.

A landing gear of the "split" type is fitted, and from the views it will be seen that this is of relatively narrow track. It has, however, been found that the stability on the ground is sufficient. The telescopic legs of the landing gear are of a special patented type, and possess great shock-absorbing qualities. The landing-gear wheels are provided with brakes, and these are so arranged that they can be used together or independently. They are operated by toe pedals on the rudder bar, and can be locked on by a hand brake lever in the cockpit. A reduction of 50 percent in landing run is gained by applying the brakes simultaneously. The wheels are partly enclosed in "spats."

A low-pressure castoring tail wheel takes the place of the old type of tail skid, and in conjunction with the wheel brakes makes maneuvering on the ground quite easy, and avoids the need for a separate tail trolley (fig. 5).

The "Wallace" can also be produced as a twin-float seaplane, and the fittings on the fuselage are arranged to take either wheel or float type (fig. 8). Skis can also be fitted if the airplane is to be used in localities

where snow-covered ground or frozen lakes are found. The floats are of duralumin construction, with straight rounded top and stepped vee bottom. Water rudders are fitted to the stern of the floats, and are connected to the rudder bar. At 5,850 pounds gross airplane weight, the excess buoyancy is 100 percent.

The Bristol "Pegasus" engine is fitted in the nose of the fuselage (fig. 9), and is provided with a radial exhaust ring which, in conjunction with the Townend cowl-ing ring, materially decreases the drag of the engine (figs. 10 and 11). The gasoline tanks are of welded aluminum, anodically treated against corrosion and painted. The main tank, which is of cylindrical shape, is placed in the fuselage, approximately on the center of gravity, so that as its contents are consumed the trim of the airplane is not altered. The auxiliary gasoline tank and the oil tank are placed farther forward in the fuselage. A combination of pressure and gravity gasoline feed is employed. The total tank capacity is 131 gallons, and the oil capacity 14 gallons. The oil is cooled by an oil radiator. If the "Wallace" is required for long-distance work, a considerable extra quantity of fuel can be carried. In that case the bombs under the lower wing are omitted, and streamline gasoline tanks fitted instead, each of 60-gallon capacity. The range then becomes 1,000 miles.

The pilot's cockpit aft of the top wing is so situated that a very good view is obtained. The deck fairing in front of the pilot, it will be seen, slopes away to the engine, and from the cockpit the upper part of the Townend ring is seen "edge on," so that it does not obstruct the view greatly. The pilot's seat is so arranged that it can be raised and lowered, and the foot bar has an adjustment to enable pilots of different height to be suited. Particular care has been taken to exclude draft from the cockpit.

To relieve as much as possible the pilot during a long flight, provision has been made not only for trimming the airplane in a fore and aft sense by means of a trimming stabilizer operated by a wheel in the cockpit, but the airplane can also be trimmed directionally by a rudder bias gear on the rudder bar.

In the observer's cockpit, close behind that of the pilot, there is a Scarff gun ring for the movable machine gun. The observer's seat is of the tip-up type, and the

floor can be moved out of the way when the prone bomber's position is used. The field of fire from the rear gun is very wide, and by using the firing steps on each side of the floor, the gunner can fire vertically downward on either side.

Parachute and ammunition racks are fitted, and a camera may be mounted on the fuselage floor, behind the cockpit, and operated by remote control. To leave the cockpits as unencumbered as possible, especially with parachute jumping in view, the control cables are taken, in the vicinity of the cockpits, through the inside of the fuselage fairings, i.e., between the primary structure and the outer covering. To trim the airplane when no observer is carried, there is a small stowage space just in front of the tail, into which suitable weights can be loaded.

The total weight of bombs which can be carried is 500 pounds in normal service. But for special purposes this load can be, and has been, increased to 1,000 pounds.

The forward air-cooled gun is, of course, fixed and fires through the propeller, a Constantinesco interrupter gear being fitted. The gun is completely enclosed in the port fuselage fairing, but is within reach of the pilot for clearing stoppages, etc. An automatic air-cooled gun is normally fitted on the Scarff gun ring in the rear cockpit, but duplicate guns can be mounted if desired.

In conclusion, it may be pointed out that the "Wallace" has, of course, been designed to the load factors laid down by the British Air Ministry, and complies with these factors both for normal flying at a gross weight of 6,300 pounds and for "aerobatics" at a gross weight of 5,650 pounds. The original airplane was type-tested at the Aeroplane and Armament Experimental Establishment at Martlesham Heath.

## SPECIFICATIONS

## Dimensions:

Length (over-all)	10.48 m	34 ft. 2 in.
Wing span	14.17 "	46 " 5 "
Wing chord	1.75 "	5 " 9 "
Wing area	45.34 m <sup>2</sup>	488 sq.ft.
Wheel track	2.08 m	6 ft. 10 in.

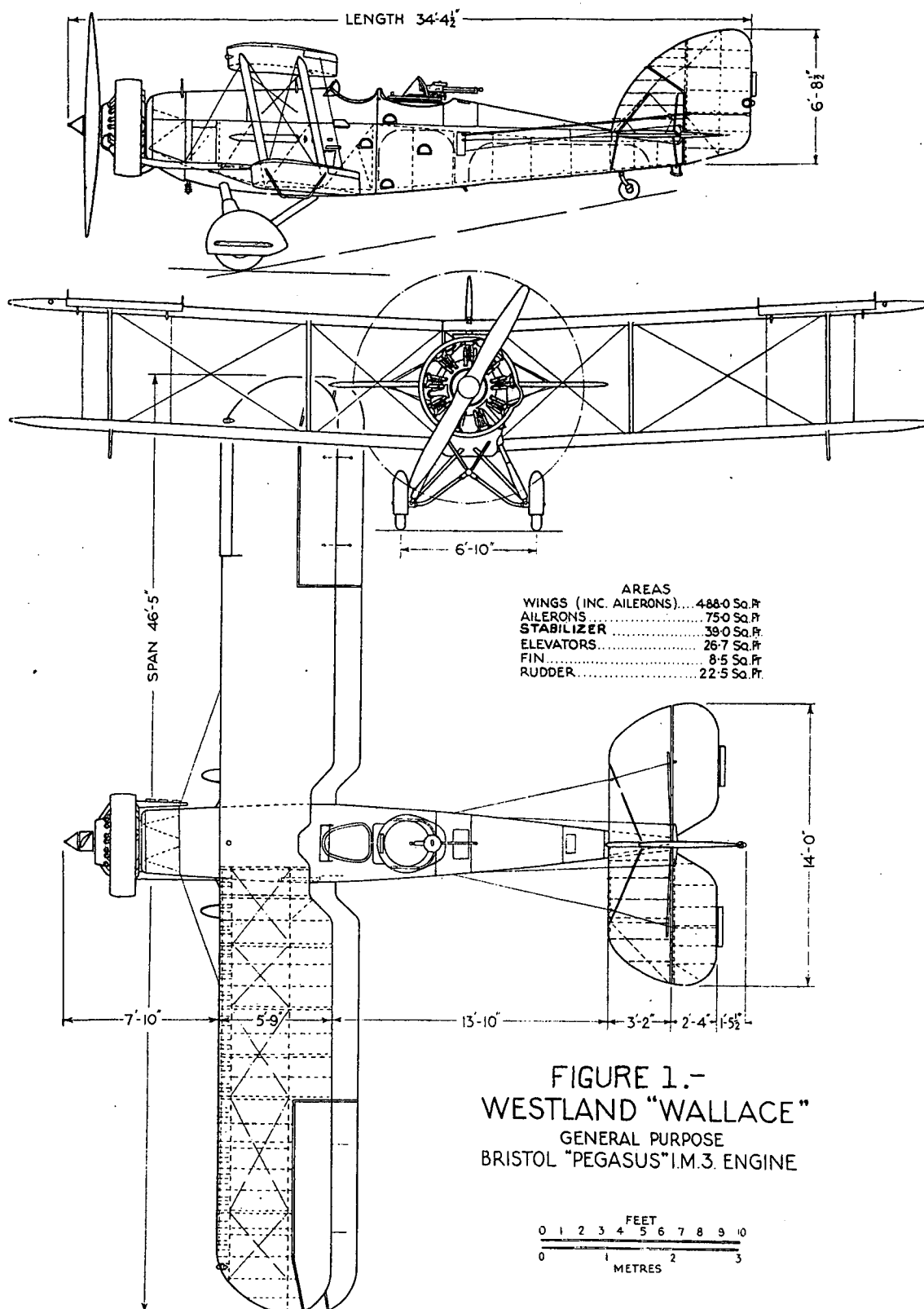
## Weights, etc.:

Tare weight	1,596.6 kg	3,520 lb.
Fuel (105 gallons)	367.4 "	810 "
Oil (10 gallons)	44.0 "	97 "
Crew, load and equipment	600 "	1,323 "
Gross weight	2,608 "	5,750 "
Wing loading	57.37 kg/m <sup>2</sup>	11.75 lb./sq.ft.
Power loading	4.7 kg/hp	10.35 lb./hp

## Performance:

Top speed at 5,000 ft.	259 km/h	161 mi./hr.
" " " 10,000 "	252.7 "	157 "
" " " 15,000 "	241.4 "	150 "
Stalling speed	97.4 "	60.5 "
Service ceiling	6,950 m	22,800 ft.
Absolute ceiling	7,400 "	24,300 "
Time to 5,000 ft.	4 min.	
" " 10,000 "	8.8 "	
" " 15,000 "	15.8 "	
" " 20,000 "	28 "	

The performances given above refer to standard atmosphere. The effect of bombs or other equivalent resistances will slightly reduce the performances.





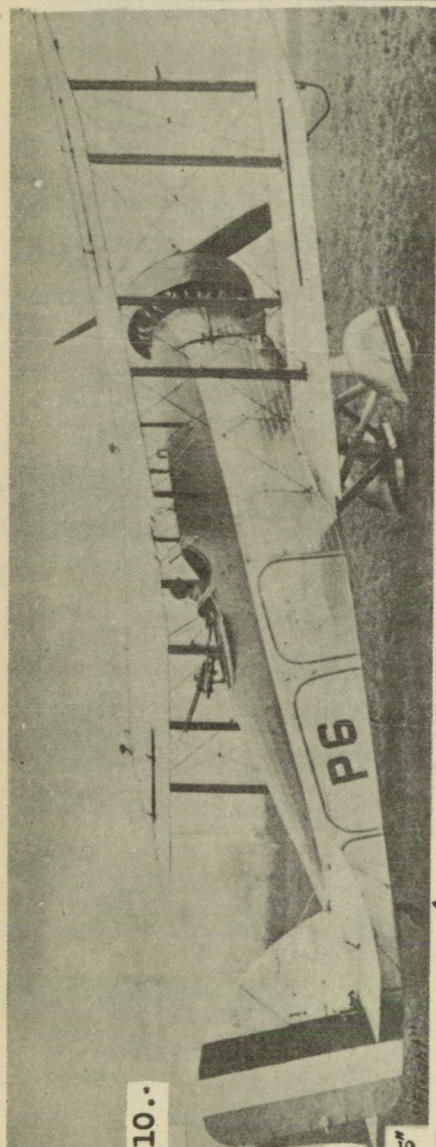


Figure 10.-  
View through  
the Townend  
ring which  
surrounds  
the "Pegasus"  
engine.

Figures 2, 3.-The three-quarter views of the  
Wallace (P.V.6.) airplane. Note ---  
the low-drag cowling over the Bristol  
"Pegasus" engine.

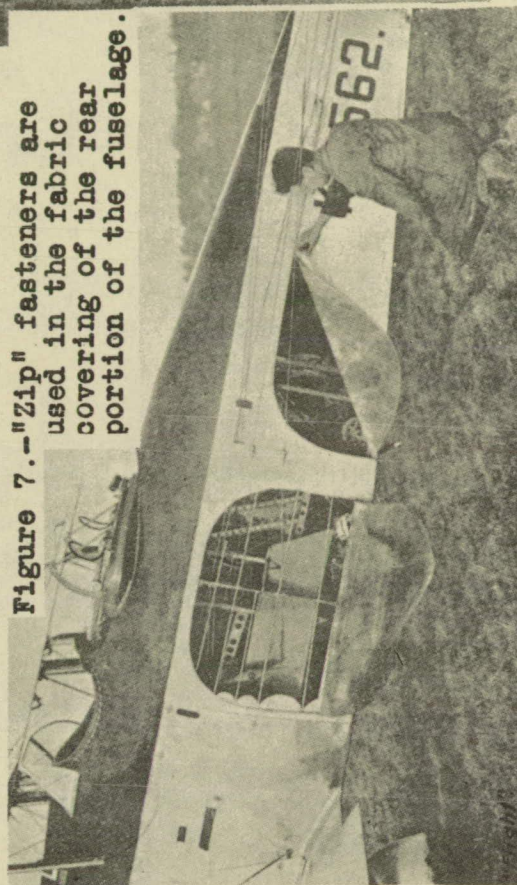
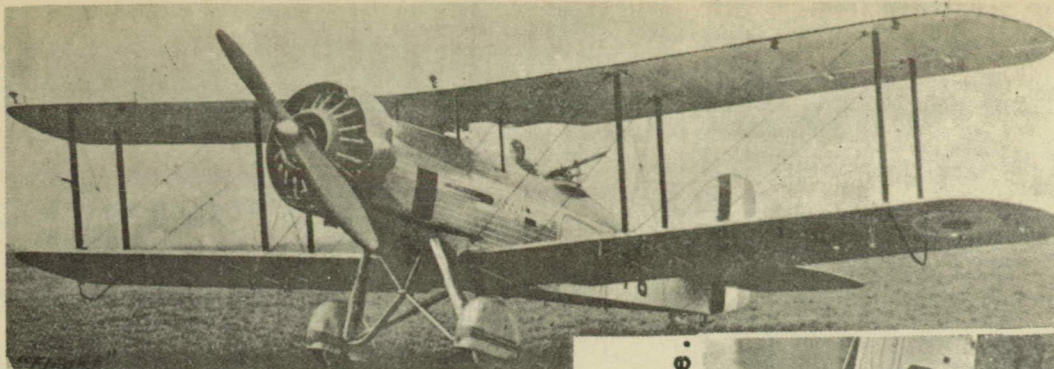
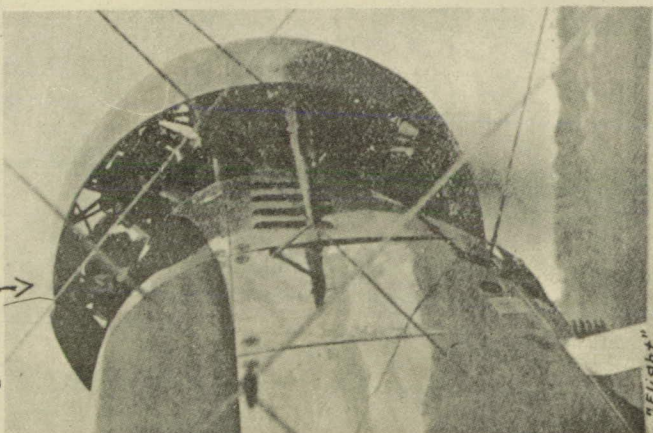
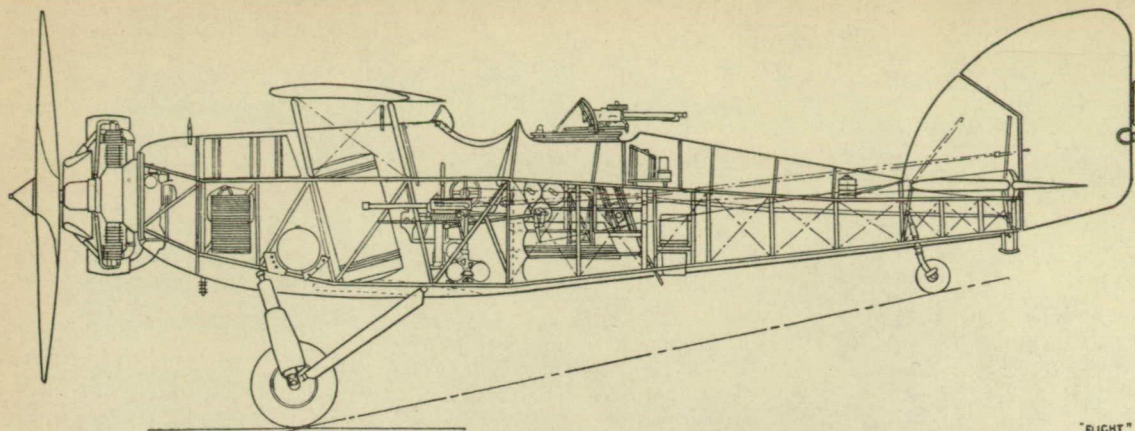


Figure 7.-"Zip" fasteners are  
used in the fabric  
covering of the rear  
portion of the fuselage.



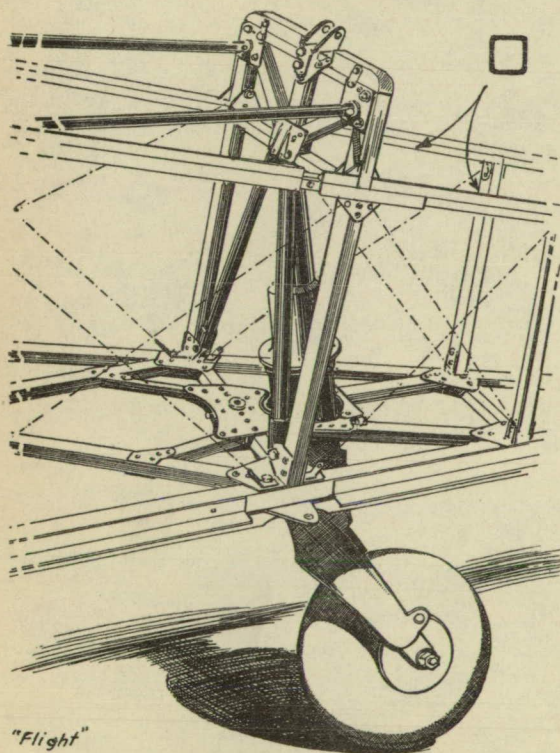
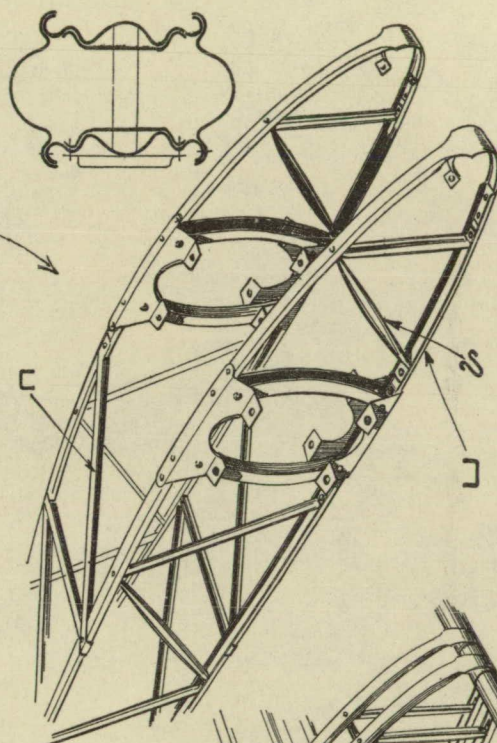




"Flight"

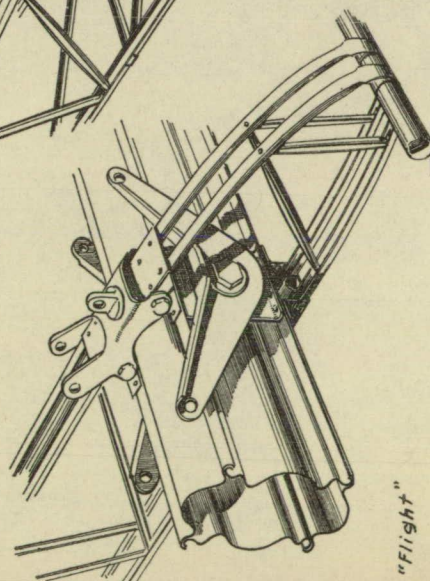
Figure 4.—Sectional view showing placing of equipment in the "Wallace" airplane.

Figure 6.—  
On the left a  
steel spar with  
its rib, strut,  
and bracing  
attachments.  
On the right,  
details of ribs  
and spar.



"Flight"

Figure 5.—Mounting of the  
castoring tail  
wheel.



"Flight"



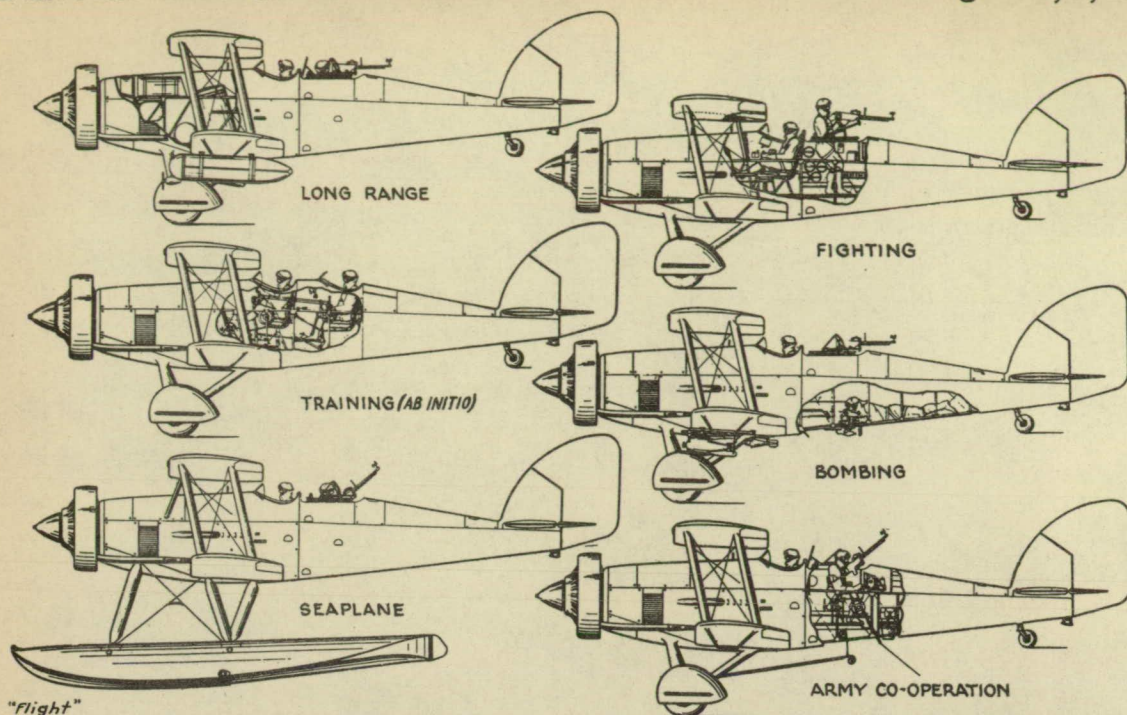


Figure 8.—Some of the many functions of the P.V.6. "Wallace" airplane illustrated diagrammatically.

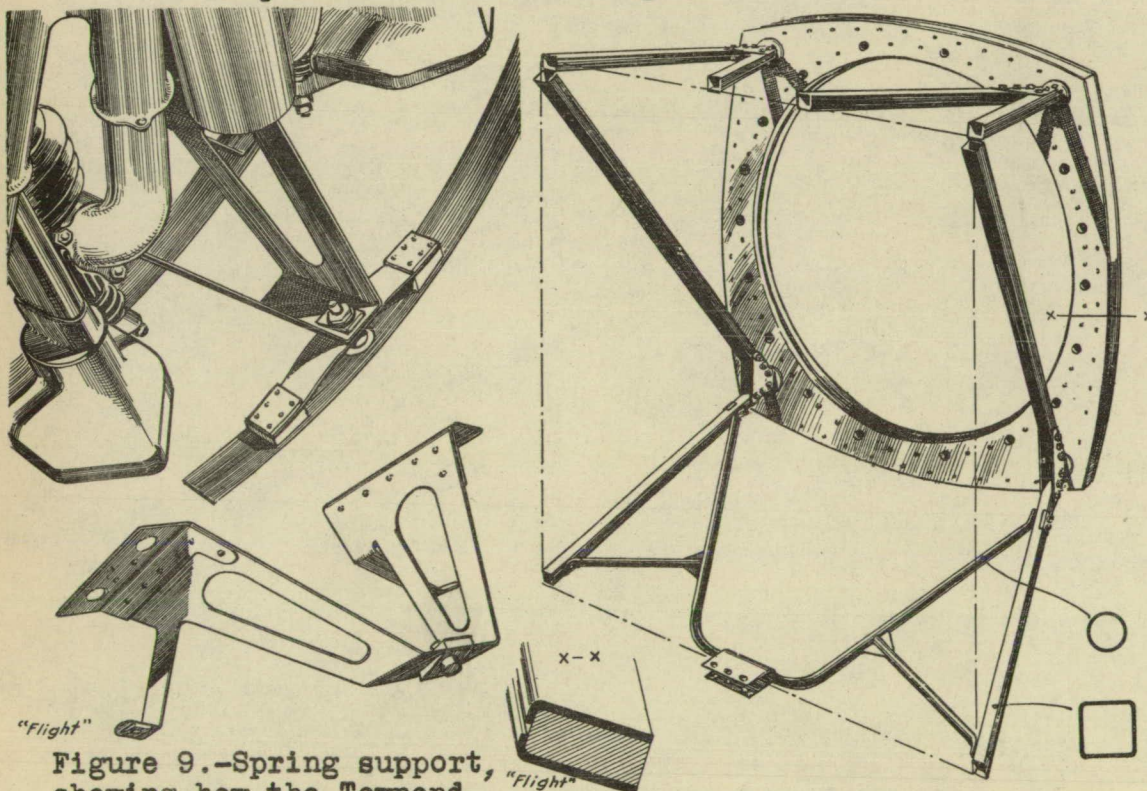


Figure 9.—Spring support, showing how the Townend cowling ring is carried on the "Pegasus" engine of the "Wallace" airplane.

Figure 11.—Engine support in the "Wallace".